

# EXHIBIT 4

# **General Causation Expert Report of Steven B. Bird, MD**

## **Bladder Cancer**

**Prepared by:**

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known to cause bladder cancer.

In my opinion, the water at Camp Lejeune more likely than not causes bladder cancer—comfortably exceeding the at least as likely standard set forth by Congress. Furthermore, I believe that the quantitative risk of bladder cancer from exposure to the combination of TCE, PCE, vinyl chloride, and benzene is more likely than not additive or even higher.

## **V. THE CHEMICALS FOUND AT CAMP LEJEUNE THAT CAN CAUSE CANCER**

The major drinking-water contaminants of interest at Camp Lejeune are volatile organic chemicals (VOCs): mainly trichloroethylene (TCE) and tetrachloroethylene (also known as perchloroethylene or PCE), but also benzene and vinyl chloride (as well as other chemicals that I will not address in this report). All those except benzene are halogenated, short-chain aliphatic hydrocarbons (halocarbons) - benzene is an aromatic hydrocarbon.

### **A. THE CHEMICALS AT CAMP LEJEUNE GENERALLY**

To understand how exposure to the contaminated water at Camp Lejeune can cause bladder cancer, it's useful to consider how the underlying chemicals present can affect human health generally. TCE, PCE, benzene, and vinyl chloride are all organic solvents.

A solvent is a substance that dissolves another substance. While water is the most common solvent, a number of substances (especially those with oils as part of their make-up), do not dissolve well in water. Organic solvents are a class of solvents made up of chemical compounds - primarily carbon and hydrogen (hence the term “hydrocarbon”) - sometimes combined with other elements (e.g., chlorine), are often used to aid this process. These solvents dissolve fat and oil easily. In turn, organic solvents are also able to dissolve in fat.

As a result of their ability to dissolve in fat (known as lipophilicity), organic solvents can permeate the human body. For example, organic solvents are uniquely able to affect the brain and nervous system by easily crossing the “blood brain barrier.” This natural protective barrier separates circulating blood from the fluid from the brain, isolating the central nervous system from the rest of the body. Because of the substantial fatty component in skin, organic solvents are also easily absorbed through the skin.

Many organic solvents are volatile (easily evaporated), leading to possible exposure through inhalation. Where these solvents are present in the water supply, they can easily move into the air under conditions such as showering, dishwashing, or toilet flushing. They can also enter homes through groundwater in a process known as vapor intrusion.

Because TCE, PCE, benzene, and vinyl chloride are organic solvents, their presence in a primary water source, like at Camp Lejeune, can result in exposure through ingestion of food and water,